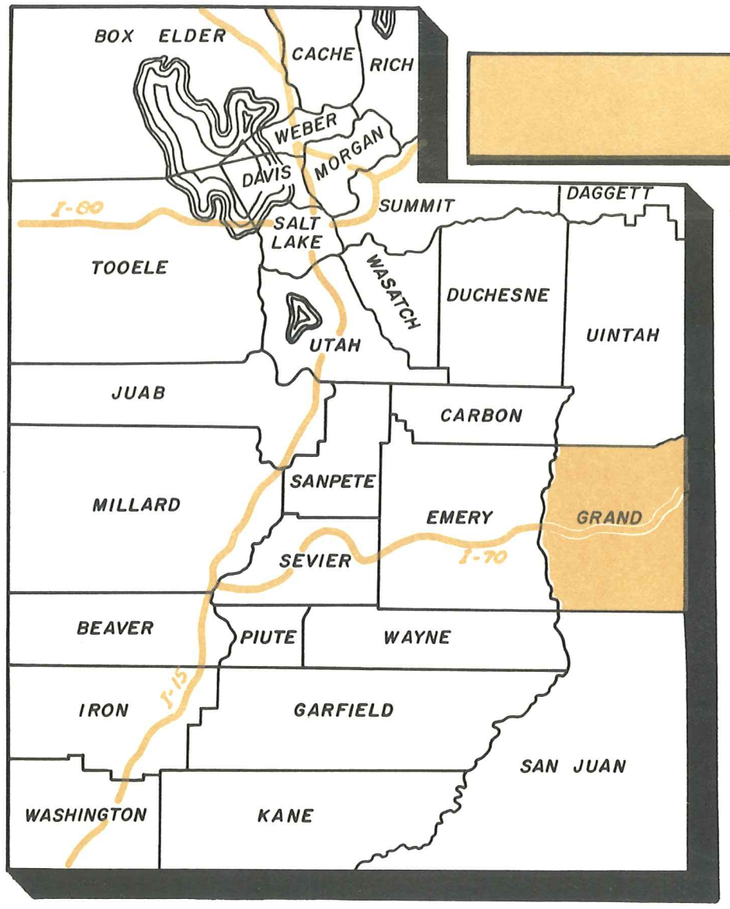


MATERIALS INVENTORY

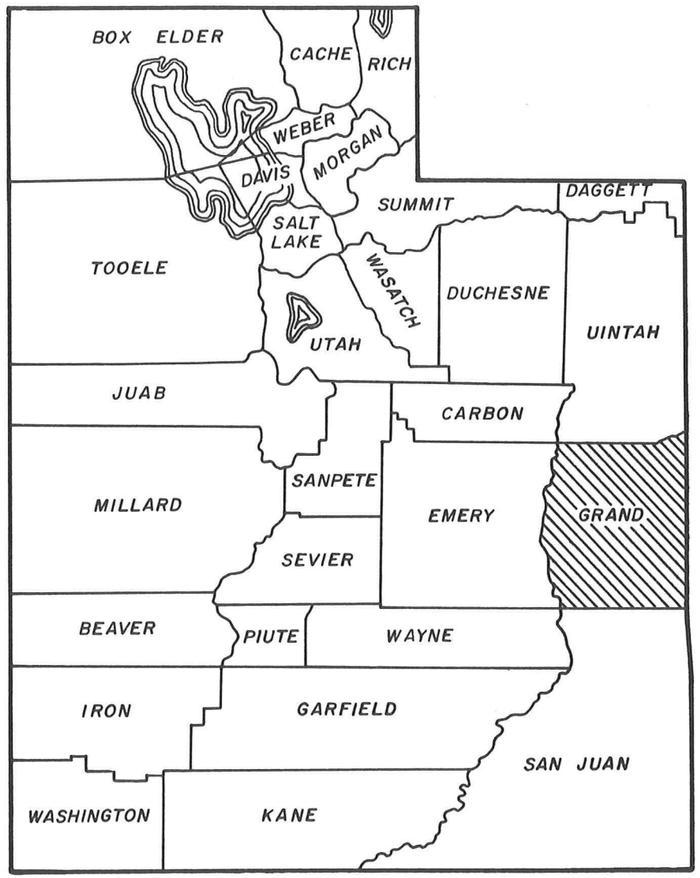
GRAND COUNTY

- POTENTIAL SOURCES
- PIT LOCATIONS
- TEST DATA
- GEOLOGY

UTAH STATE DEPT. OF HIGHWAYS
MATERIALS & RESEARCH DIVISION
MATERIALS INVENTORY SECTION

MATERIALS INVENTORY

GRAND COUNTY



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Utah State Department of Highways

REVISED AUGUST 1971

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LIST OF FIGURES

PURPOSE

The purpose of the Materials Inventory is twofold. First, it enables the Utah State Department of Highways to more accurately locate, investigate, and catalog the materials needed for highway construction. Second, it makes possible a system by which an accessible, permanent, and up-to-date record may be kept on every known materials site.

The inventory is valuable in avoiding wasteful duplication of work in locating materials sites. General information on known materials sites and prospective sites will be available on a county basis in booklet form. More detailed information is available from a central file in the Materials Inventory Section of the Materials and Research Division and in the respective District Materials Sections.

Notwithstanding the enormous quantities of road-building materials that are now available in Utah, it must be realized that one day these materials may be depleted or completely unobtainable due to the encroachments of man. As highways improve, the quality of materials that are used in highway construction must also improve. Good quality material is not readily available in all places, and this fact alone makes it necessary to locate and secure choice sites before they are depleted or become unobtainable. The advent of the Federal Highway Program has further emphasized the necessity for large quantities of high quality material for highway construction. The Materials Inventory is designed to collect, organize and tabulate all useful information related to materials available or potentially available for highway construction.

PROCEDURES

The Materials Inventory is accomplished by a logical step by step sequence as follows:

1. Compilation of all available site data from existing files and records.
2. Acquisition of available geologic and soil map coverage of the county.
3. Plotting the above information on 1 inch = 1 mile county maps.
4. Field examination of each site to determine quantities available, to collect samples as needed, to check geologic and soil contacts, and to observe the physical setting for feasibility of material removal.
5. Preparation of the finished report.
6. Establishment of a permanent record in the Materials Division and District files to include detailed information concerning each site.

To assist in accomplishing the foregoing results, three special forms have been prepared, all of which become part of the permanent records. These forms provide details concerning the individual sites. One copy of each form is kept in the District files and one copy in the Central Materials Inventory files. The MI-1 form is designed to assist in compiling available file data and in making the field examination. A copy of this form is illustrated in Figure 1-a. It contains information relating to the approximate grading, type of material, type of deposit, rock types, surface conditions of the site (indicating obstructions to excavation, etc.), area, accessibility of the site, quantity, site number, ownership, and location. This is a specially designed form of "Needle Sort" printed by Business Forms, Inc. Notice the edges of this card. By punching or notching the card according to the code (Figure 1-b) and using the sorting needle, it is possible to rapidly sort, arrange, classify or select any information recorded on any card or group of cards in the filing system. The "Needle Sort" instruction manual gives detailed instruction as to the operation and use of this system and the reader should refer to this manual for more detailed information.

Form MI-1 is completed by the investigator as he visits each site. If laboratory test data are not available, the investigator collects a representative sample of the material, upon which laboratory tests are later performed to determine its suitability for use in highway construction.

Pertinent information from these test data is recorded on Form MI-2 (see Figure 3). This form also includes a sketch map of the deposit showing the tract subdivision, outline of the material site, drill holes, other sampled locations and information such as direction and distance from a survey station or highway. Drill hole or other sample information is logged in the columns below the sketch map.

The MI-3 form (see Figure 2) is designed to aid in the maintenance of current records. It is to be completed by the project engineer after pit operations have ceased. Included on the form are items such as quantity removed; the type, size and quality of material; and physical factors involved in pit operation.

The finished county report contains a sheet designated as "Description of Geology", describing the various geologic and soil units in detail. Following this is the "Pit Locations and Potential Sources Map". As might be inferred, this shows the location of known sites by number and symbol on a geological map, all placed on a county highway map base. The geologic information shown on the "Pit Locations and Potential Sources Map" represents a compilation from various published and unpublished sources, after field checking in pertinent areas.

MATERIALS INVENTORY FORMS

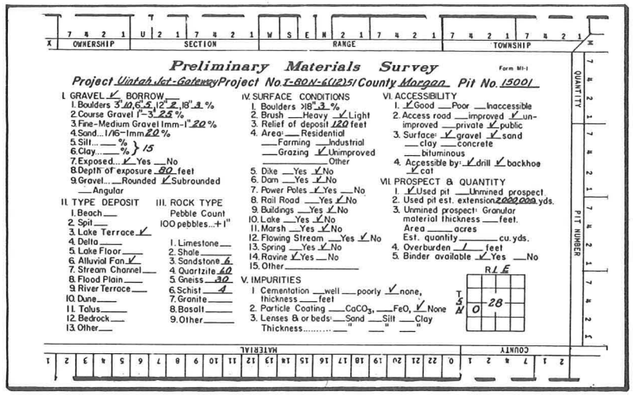


Figure 1-a. Reproduction of the Preliminary Materials Survey Form MI-1 on the Needle-Sort card. The actual card is 8 x 5 inches.

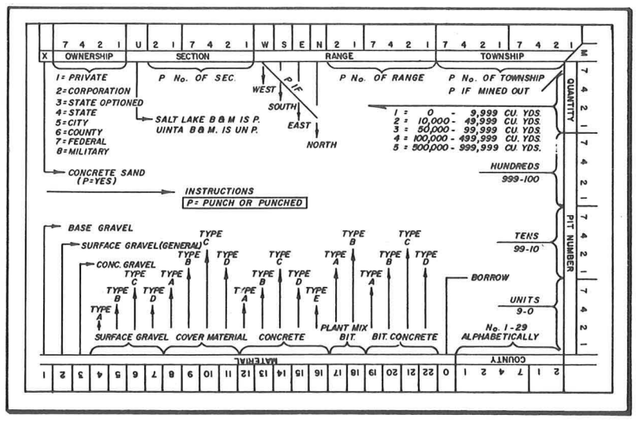


Figure 1-b. Reproduction of code card used in punching Form MI-1. The actual card is 8 x 5 inches.

PIT EVALUATION REPORT

Form MI-3 (Rev. 6-64)

To: Engineer of Materials and Research

Project Name & No. _____ Date _____

Pit or Prospect No. _____ Station Location _____

Legal Description _____

TYPE OF MATERIAL	MATERIALS REMOVED (CU. YDS.)
Base Gravel	
Surface Gravel (Type)	(Cu. Yds. or Tons)
Concrete Sand	
Concrete Gravel	
Bituminous Surface Course Aggregate	
Granular Backfill Underdrain	
Borrow	
Other Material (Rip Rap, Chips)	
Total Gravel Removed	

Comments:

Quality of Material _____

Uniformity of Material _____

Lenses.....gravel _____ sand _____ silt _____ Clay Thickness _____

Amount of Oversize (+12") _____ % Average thickness of Overburden _____

Estimated Quantity Remaining _____ cu. yds.

Further Investigation necessary to determine remaining quantity: yes _____ no _____

Features of Pit: _____

Difficulties of Operation: _____

Recommendations for Future use of Pit: _____

cc: District Materials Engr.

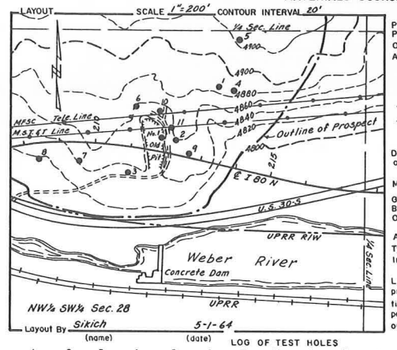
By: _____
Project Engineer

Figure 2. Reproduction of the Pit Evaluation Report Form MI-3. The actual form is 8 ½ x 11 inches.

UTAH STATE DEPARTMENT OF HIGHWAYS

MATERIALS SOURCE DATA

Form MI-2



Pit No. 15-001 Project Name Uintah Jct - Gateway
Project No. I-80N-6(12)151 County Morgan State Utah
Owner U.S.A. (Wasatch National Forest)
Address _____

Property
Optioned _____ Expiration Date _____
Cost: _____ per Cu. Yd. _____ per Ton
Public Domain Set Aside _____
Date From 1964 To 1969
Prospect Only ✓

T 4 N, R 1 E, Sec. 28

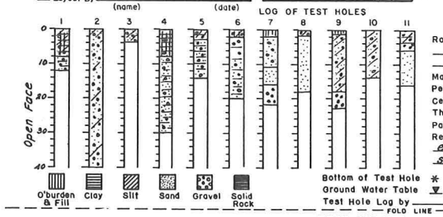
Dead Haul _____ miles to _____
or _____ miles to _____

Material	Thickness (ft.)	Quantity (cu. yds.)
Gravel	60	2,000,000
Borrow		
Overburden		

Area of Deposit 43 acres
Type of Deposit Alluvial fan & Lake terrace
Investigations with: Drill _____ Backhoe _____ Cat _____
Other _____

LAYOUT INSTRUCTIONS: Show deposit layout, with test holes properly located and numbered. Indicate the north point, land ties, land lines and ownership. Show topography, drainage, power poles, or other obstructions to excavation. Gravel should be outlined in green, borrow in brown, and haul roads in red.

LOG OF TEST HOLES



ADDITIONAL PIT DATA

Rock Type (% of Each) Gneiss 30 % Quartzite 60 % Sandstone 6 % Schist 4 %
Maximum Size 18"
Percent oversize (+12") - 5 %
Cementation of Deposit ✓ None ___ Partial ___ Complete.
Thickness of Cementation ___ ft.
Particle Coating None
Remarks Old pit has not been worked since early 1930's. Complete outline of prospect shown on supplementary map in Central Materials Inventory file.

FOLD LINE

TEST VALUES

GRAVEL

Test Hole No. Field Sample Number	Laboratory Number	Sample Depth (ft)	Sieve Analysis (% Passing) Before Crushing: 3"	2"	1"	¾"	No. 4	After Crushing: 1"	¾"	½"	⅜"	No. 4	No. 8	No. 10	No. 30	No. 200	Liquid Limit	Plastic Index	Swell	Absorption	Wear L.A. Rattler	Na2SO4 Loss: +4	-4	Fracture Face Count	ICT-1 Ave PSI: W/O Lime	W/ Lime
Comb	Bank	214-SA-64	0-30	98.7	93.9	80.7	52.6	38.2	100.0	98.3	73.6	60.3	43.1	33.1	25.0	13.2	6.3	18.2	N.P.	.007	.028	31.1	4.97	10.06	93	171	250
9		207-SA-64	05-9	98.6	90.7	74.9	56.4	44.0	100.0	98.1	81.1	70.9	53.2	41.7	31.5	16.1	6.7	17	N.P.	.009	0.53	31.0	8.53	9.06	90	128	153
7		208-SA-64	5.5 ft. B.H.	93.5	86.8	67.2	52.4	43.2	100.0	93.6	78.3	69.5	55.7	47.9	42.9	31.7	5.4	17	N.P.	.011	0.64	24	7.22	2.83	85	146	202

ADDITIONAL INFORMATION

BORROW

Test Hole No.	Field Sample Number	Laboratory Number	Sample Depth (ft)	Maximum Size	Laboratory Values: Percent Passing: ¼"	3"	2"	1½"	1"	¾"	No. 4	No. 10	No. 20	No. 40	No. 200	Percent: Gravel	Coarse Sand	Fine Sand	Silt - Clay	Liquid Limit	Plasticity Index	C.B.R.: Min % Str.	Dry Den. lbs/ft³	Proctor: Opt. % Moist.	Dry Den. lbs/ft³	Swell	Classification A.A.S.H.O.

Samples Submitted by _____ (name) _____ (date)

Test Data Added by _____ (name) _____ (date)

Figure 3. Reproduction of the Materials Source Data Form MI-2. The actual form is 11 x 17 inches.

Test information for samples obtained from each site is summarized on the "Test Data Sheet," with the corresponding pit number for identification.

Through proper use of the geologic maps, the description of geologic units, and test information, the locations of additional possible sites may be inferred.

Certain pits may contain both gravel and borrow material. As a general rule, it is assumed that any pit capable of producing gravel can be used for borrow if conditions warrant. Consequently, a pit capable of producing satisfactory gravel is normally shown as a gravel pit on the "Pit Locations and Potential Sources Map" even though it may be primarily used for borrow.

In may areas, especially where quality gravels are scarce, many sites are investigated and sampled only to find that they do not meet standard specifications. In order to avoid wasteful duplications in re-investigating and re-sampling these deposits, they are shown as rejected gravel sites on the "Pit Locations and Potential Sources Map." Rejection of these sites is usually based on excessive wear, swell, liquid limit, plasticity, sodium sulfate loss, or failure to pass the immersion-compression test. Grading is seldom a requisite for rejecting a deposit because it is assumed that any coarse aggregate can be processed to meet standard grading specifications by crushing, blending or wasting part of the material. Potential borrow sites are rejected only if there is better quality material available in the immediate area. A separate "Test Data Sheet" giving the reason for rejection as well as the laboratory test values is used for the rejected sites.

REPORT PREPARATION

Field investigations for the Grand County Materials Inventory were conducted by geologists from the Materials Inventory Section, Materials and Tests Division, Utah State Department of Highways. Material sites were investigated and mapped during March, 1967.

The geology depicted on the "Pit Locations and Potential Sources Maps" was taken from the 1964 Geologic Map of Southeastern Utah. The map was compiled by L. F. Hintze and W. L. Stokes and published by the Utah Geological and Mineralogical Survey.

GEOLOGICAL ASPECTS

Grand County, covering approximately 3700 square miles, is part of the Colorado Plateau physiographic province. It is drained by the Colorado River and its main tributaries, the Green and Dolores Rivers. The tributaries arising within the county are largely intermittent and are subject to flash floods during the late summer.

The northern part of the county is occupied by the Roan Plateau which is part of the southerly limb of the east-west trending Uinta Basin syncline. The prominent Book Cliffs form an escarpment along the southern edge of the Roan Plateau. The bedrock of this part of the county has a gentle dip northwards into the syncline of the Uinta Basin.

The southern part of the county has a series of northwesterly trending anticlines caused by intrusive masses of salt and gypsum. The anticlines are broken by faults on one or both flanks.

Stratigraphically the bedrock formations range from the Tertiary Green River Formation down to the Pennsylvanian Hermosa Formation. In the southeast corner of the county and north of the La Sal Mountains is a series of Precambrian metamorphic schists and gneisses. The core of the La Sal Mountains consists of monzonite, diorite, and syenite porphyry intrusives. With the exception of the Precambrian and intrusive rocks in and near the La Sal Mountains, the bedrock of the county is composed largely of relatively soft sandstones, siltstones, and shales. Interstate 70 will be constructed upon the area in which the bedrock is the Mancos Shale. These shales have caused foundation and subgrade problems because of their expansive nature.

Road material sources of the county are unconsolidated Quaternary deposits. Generally, the sedimentary rocks are soft and have high wear and high sodium sulphate loss characteristics. The metamorphic and igneous gravels are well within specifications for all quality tests. The Quaternary deposits are generally alluvial, flood plain, stream channel, river terrace, or bars. In some cases they are residual pediments of alluvium and colluvium derived from the erosion of the Book Cliffs. Along the Green and Colorado Rivers and the drainage from the La Sal Mountains are alluvial bars and terraces in which the gravels were derived from metamorphic and intrusive rocks.

DESCRIPTION OF GEOLOGY

Qar

Recent alluvium & colluvium

Channel and floodplain deposits related to perennial or intermittent streams; alluvial fans; talus and other colluvial deposits; form potential aggregate sources where gravel is present in sufficient quantity.

Tgr

Green River Formation undivided

Middle Eocene; brown and gray shale, brown and gray dolomitic marlstone, limy sandstone, beds of volcanic ash, bedded algal deposits, oil shale and bituminous sandstone characterize various facies of the formation; crops out in the northern part of Grand County.

Tip

Porphyritic intrusive rocks

Middle Tertiary; chiefly diorite, monzonite, and syenite porphyry which intrude older sedimentary rocks as stocks, laccoliths, and dikes. These intrusives form the core of the La Sal Mountains.

Kcbh

Castlegate & Black Hawk Sandstones

Upper Cretaceous; the Castlegate overlies the Black Hawk and consists of white to light-gray, cliff-forming sandstone. The Black Hawk contains gray, brown, and white cross-bedded sandstone with interbedded gray carbonaceous shale and coal beds.

Qco

Covering deposits

Mainly wind blown sand and silt deposits; some areas of soil and alluvium are mapped under this symbol; generally considered to be sources of borrow only.

Tw

Wasatch Formation

Lower Eocene; brownish-red, grayish green, tan, and gray, generally calcareous shales; gray, tan, brownish-red, and cream-colored sandstones; a few beds of gray, fine-grained, dense, fresh-water limestone; correlates with the flagstaff and Colton Formations of central Utah.

Kmv

Mesa Verde Group undivided

Upper Cretaceous. In the eastern section of the Book Cliffs this group consists, in ascending order, of the Sego Sandstone, Nelson Formation, and Farrer Formation. The entire section is interbedded sandstone, shale, and coal.

Kms

Mancos Shale undivided

Upper Cretaceous; in Grand County this unit can be divided from top to bottom into: (1) light-gray, easily eroded, marine shale; (2) gray, buff, and brown, fossiliferous, shaly sandstone; (3) gray, marine siltstone and claystone. Most of I-70 in Grand County will cross (1).

Qgs

Gravel surfaces

Chiefly pediments and old river terraces; includes dissected gravel-capped knolls, ridges, and benches; especially prominent south of the Book Cliffs; the principle source of aggregate in Grand County even though the gravel in some deposits does not meet soundness or wear specifications.

TKnh

North Horn Formation

Upper Cretaceous and Lower Paleocene; continental; variegated gray, green, and red shale and siltstone with interbedded fine to medium grained sandstone; contains thin, evenly-bedded, lacustrine limestone; includes a light-colored, coarse-grained to conglomeratic sandstone unit mapped as the Tuscher Formation in the Book Cliffs.

Kpr

Price River Formation

Upper Cretaceous; interbedded sandstone and mudstone of marine and fluvial origin; thins and decreases in coarseness to the east.

Kd

Dakota Sandstone

Under this symbol is mapped the Dakota Sandstone (U. Cret.) and Lower Cretaceous rocks in Grand County. In descending order they are: (1) Dakota Sandstone - light colored sandstone and carbonaceous shale; (2) Burro Canyon and Cedar Mountain Formations. The name Burro Canyon applies to varicolored shale, mudstone, sandstone, limestone, and conglomerate east of the Colorado River whereas the name Cedar Mountain applies to equivalent strata west of the river.

Morrison & Summerville Formations undivided

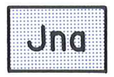
Upper Jurassic; the Morrison overlies the Summerville and consists of two members in Grand County: (1) the Brushy Basin Shale above consists of chiefly mudstone with a few coarse beds of sandstone and conglomerate; (2) the Salt Wash Sandstone below contains about equal amounts of mudstone and "channel" sandstone. The Summerville Formation is characterized by thin, regular beds of chocolate, maroon, and greenish-gray shale, mudstone, and siltstone.

Entrada Sandstone

Upper Jurassic; in Grand County this formation is mainly a single massive cliff of red to buff-colored sandstone; includes the Moab Sandstone Tongue in the upper part.

Carmel Formation

Middle and Upper Jurassic; mainly red, silty sandstone with distinctive contorted bedding.

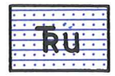


Navajo Sandstone

Lower Jurassic; yellowish-brown to buff, cross-bedded, eolian sandstone; forms cliffs and benches.

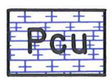
Kayenta Sandstone

Upper Triassic and Lower Jurassic; includes the Kayenta Sandstone of Early Jurassic age and the Wingate Sandstone of Late Triassic age. The Kayenta contains reddish-brown and purplish sandstone with minor shale. The Wingate consists of reddish-tan to reddish-brown, massive, cross-bedded, eolian sandstone.



Triassic rocks undivided

This unit consists of the Upper Triassic Chinle Formation and the Lower Triassic Moenkopi Formation. The Chinle is mainly red, interbedded siltstone, sandstone, and shale. The Mossback Sandstone is the basal member of the Chinle. The Moenkopi Formation is mainly reddish-brown and chocolate-colored siltstone.



Cutler Formation

Lower Permian; in Grand County this formation is mainly pink arkosic sandstone and conglomerate with minor interbedded red siltstone.

Rico Formation

Upper Pennsylvanian and Lower Permian; buff, red, and purple arkosic sandstone and conglomerate with several thin beds of tan to light-gray cherty limestone.

Hermosa Formation

Middle and Upper Pennsylvanian; in Grand County the Hermosa is mainly gray limestone, shale, and sandstone. Gypsum, salt, and black shale belonging to the evaporite facies of the Paradox Member constitute the lower part of the Hermosa Formation.

Undifferentiated Crystalline rocks

Precambrian crystalline rocks which include schists, gneisses, and granitoid rocks; outcrop in eastern Grand County.

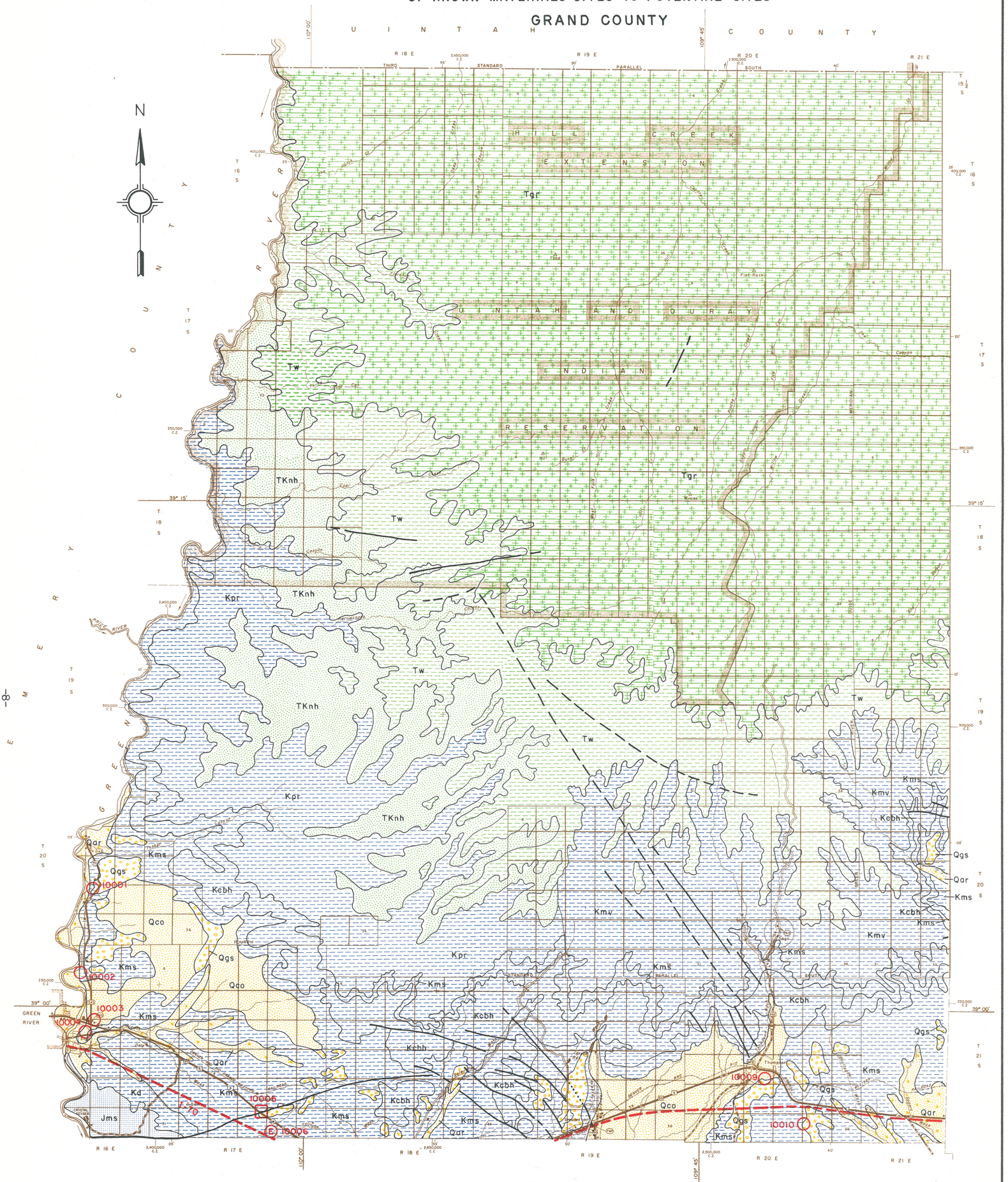
UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS AND RESEARCH DIVISION
MATERIALS INVENTORY SECTION

GENERAL GEOLOGY FROM 1964 GEOLOGIC MAP OF UTAH
DRAFTED BY I. OSPINA

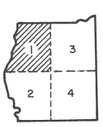
1966
PIT LOCATIONS AND POTENTIAL SOURCES MAP

SHOWING GRAVEL AND BORROW PITS AND THE RELATIONSHIP OF KNOWN MATERIALS SITES TO POTENTIAL SITES

GRAND COUNTY



GEOLOGIC BOUNDARY
FAULT
INFERRED FAULT



PORTION OF COUNTY COVERED

PIT AND SITE CLASSIFICATION

BORROW GRAVEL

- Pit which has been worked
- E Pit which has been exhausted
- Investigated site which has not been worked
- Investigated site which has been rejected
- 10023 Pit or site number
- 10-A Rejected site number

SCALE 1 0 1 2 3 4 MILES

POLYCONIC PROJECTION

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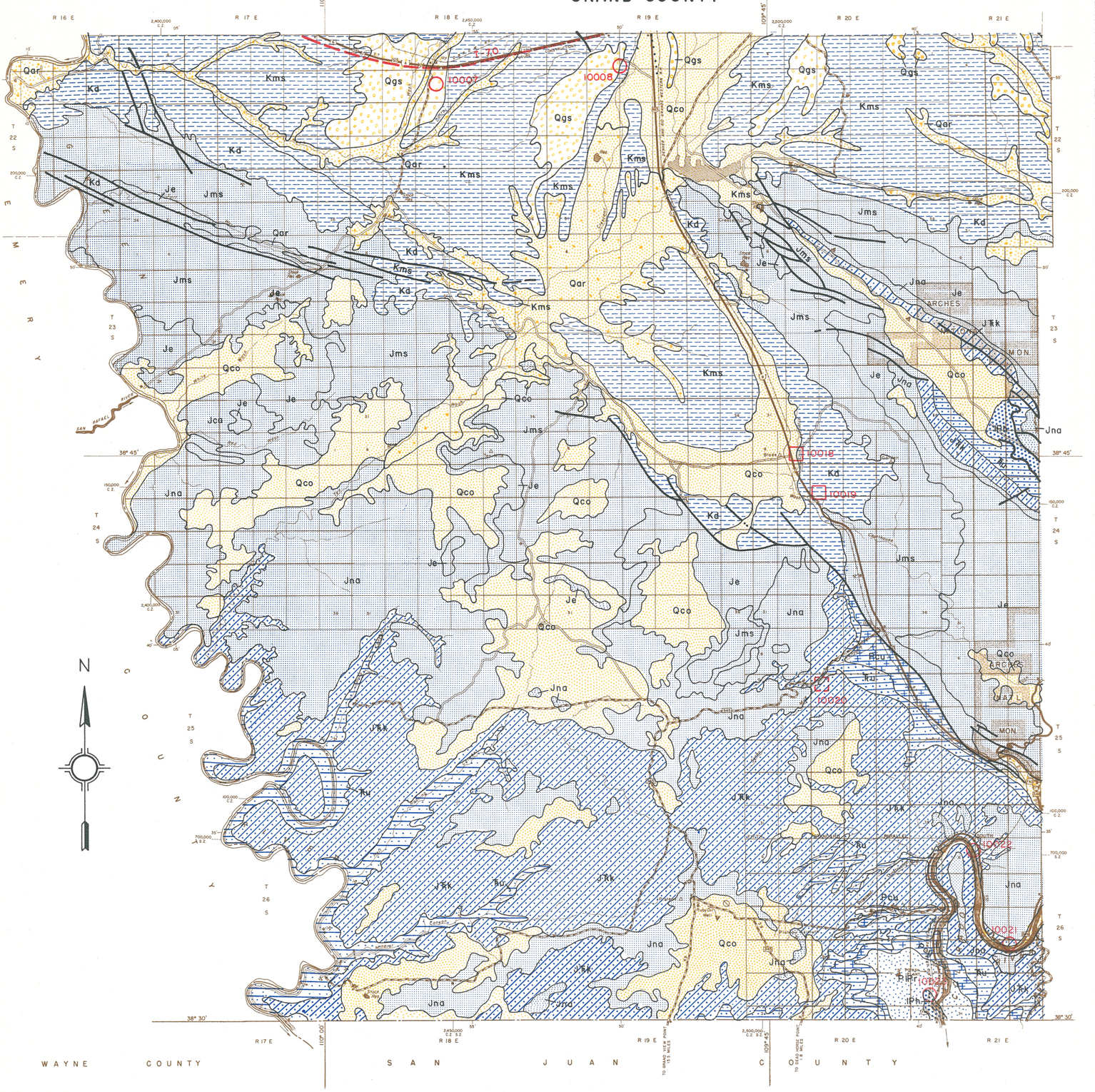

QUATERNARY

- Qar — Recent alluvium
- Qco — Covering deposits
- Qgs — Gravel surfaces

TERTIARY

- Tgr — Green River Formation undivided
- Tw — Wasatch Formation
- Tknh — North Horn Formation

CRETACEOUS

- Kmv — Mesa Verde Group undivided
- Kpr — Price River Formation
- Kcbh — Castlegate & Black Hawk Sandstones
- Kms — Mancos Shale undivided
- Kd — Dakota Sandstone

JURASSIC

- Jms — Morrison & Summerville Formations undivided
- Je — Entrada Sandstone
- Jca — Carmel Formation
- Jna — Navajo Sandstone

TRIASSIC

- TRk — Kayenta Sandstone
- Tu — Triassic rocks undivided

PERMIAN

- Pcu — Cutler Formation
- PIPr — Rico Formation

PENNSYLVANIAN

- IPh — Hermosa Formation

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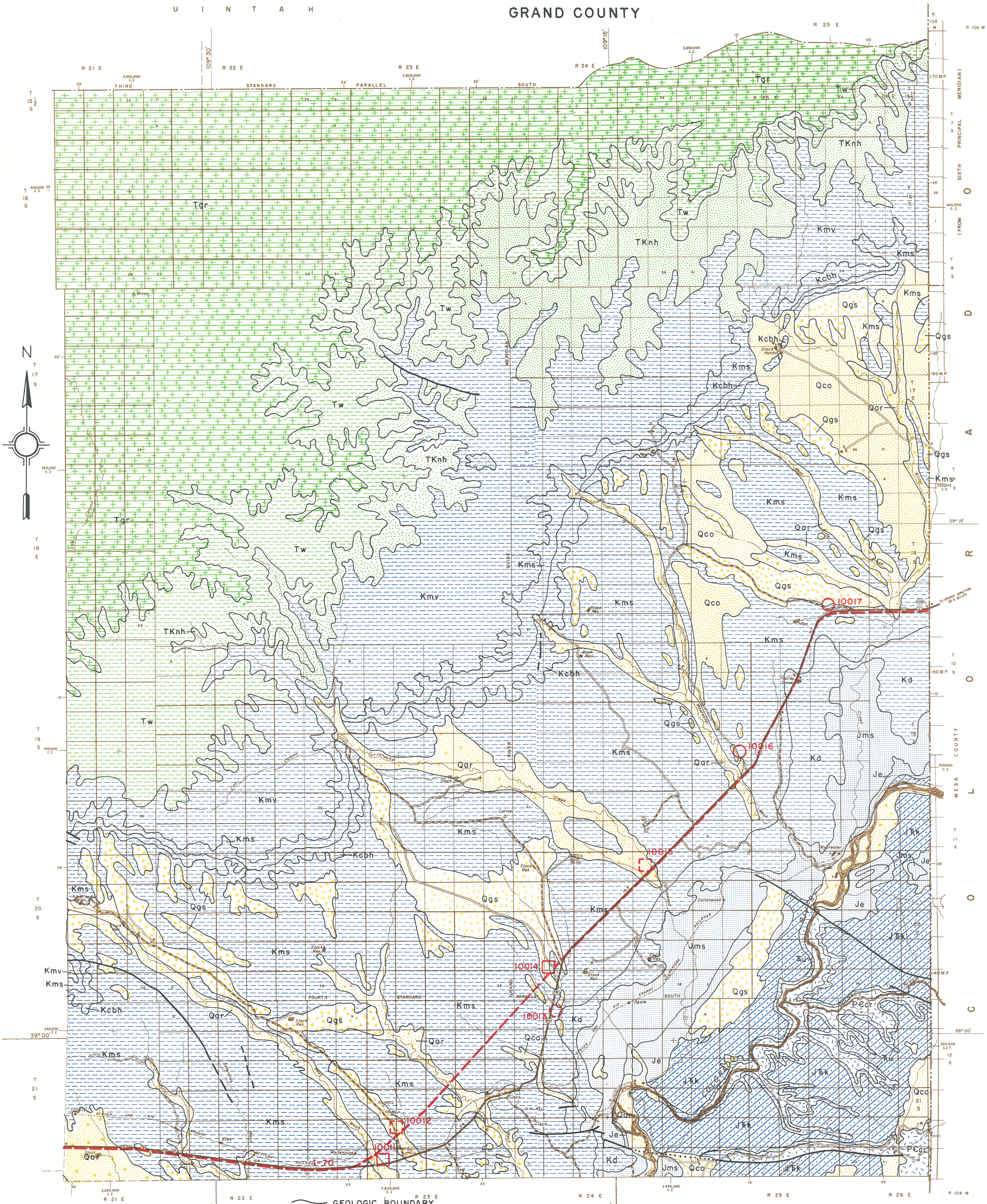

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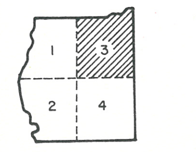

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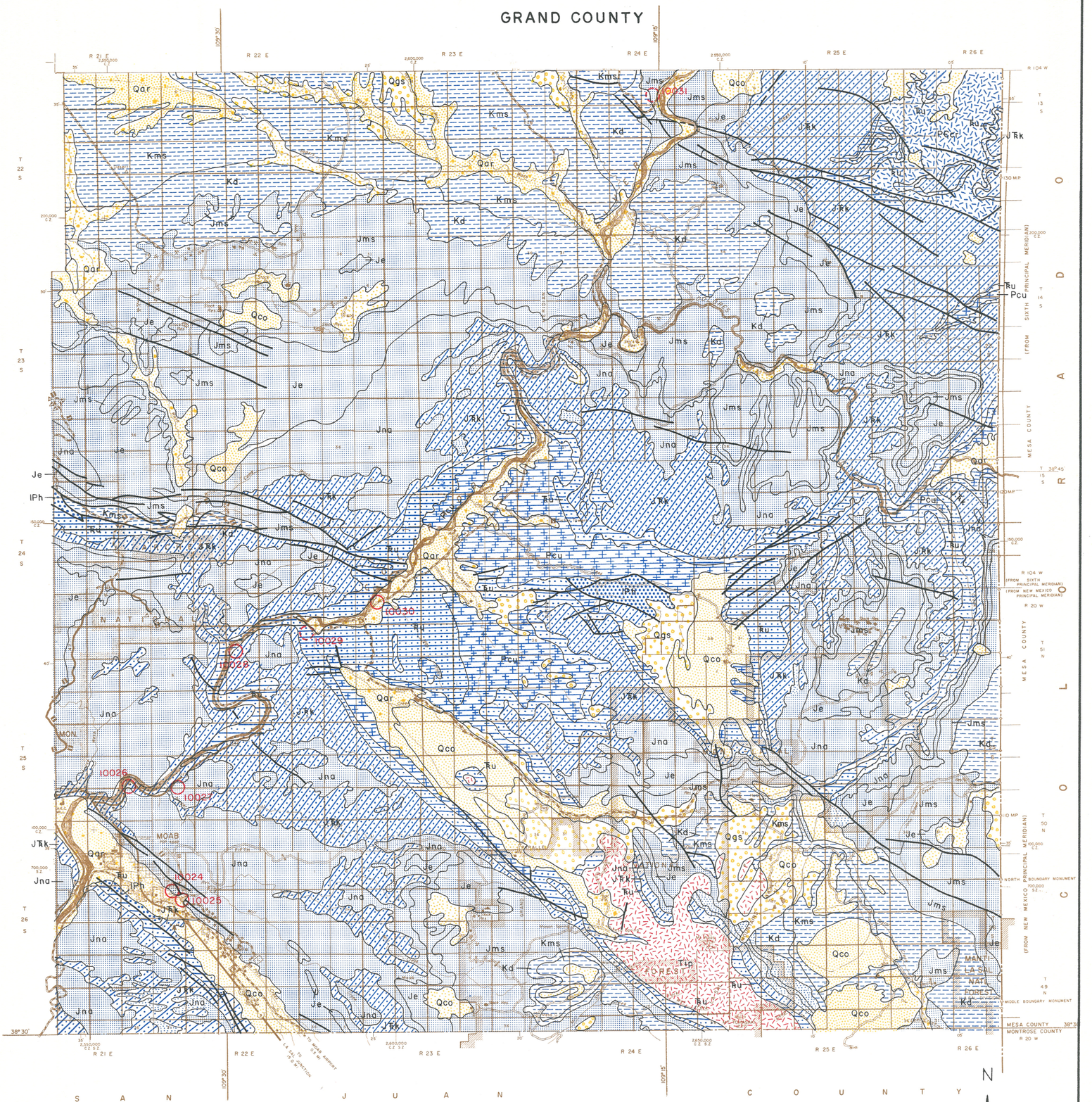

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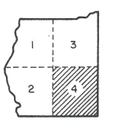
- Ru — Triassic rocks undivided

PERMIAN
- Pcu — Cutler Formation
- PIPr — Rico Formation

PENNSYLVANIAN
- IPh — Hermosa Formation

PRECAMBRIAN
- PCer — Undifferentiated crystalline rocks

N



PORTION OF COUNTY COVERED

SCALE
0 1 2 3 4 MILES

POLYCONIC PROJECTION

STATEMENT OF LIABILITY

No liability is expressed or implied concerning the quality or quantity of material listed for the respective sites. The data itemized are based upon sound geologic and/or geophysical interpretations in combination with tests performed upon material removed from the site, but due to the erratic depositional features of such deposits, this does not in any way guarantee that the material remaining is represented by the information obtained to date.

PITS AND POTENTIAL SITES - TEST DATA SHEET

LOCATION						OWNERSHIP		MATERIAL					TEST DATA - REPRESENTATIVE SAMPLE																				
																SIEVE ANALYSIS														IMMERSION COMPRESSION AVG. P.S.I.			SODIUM SULPHATE LOSS	
																BEFORE CRUSHING		PERCENT PASSING AFTER CRUSHING TO 1" MAX. SIZE										LIME				
PIT OR SITE NUMBER	TOWNSHIP	RANGE	40 ACRE TRACT	QUARTER SECTION	SECTION	P = PRIVATE C = COMMERCIAL CO = COUNTY F = FEDERAL S = STATE	OWNER	USE OF MATERIAL	TYPE OF DEPOSIT	PRESENT ESTIMATED QUANTITY (CU. YDS.)	THICKNESS OF MATERIAL	DEPTH OF OVERBURDEN	DATE SAMPLED *	TYPE OF SAMPLE	DEPTH OF SAMPLE	> 3"	> 1"	1"	1/2"	NO. 4	NO. * 10	NO. * 40	NO. 200	LIQUID LIMIT	PLASTICITY INDEX	SWELL	A.A.S.H.O. CLASSIFICATION	WO/	W/	ABRASION 500 REV.	+4	-4
10001	20S	16E	NE	NW	28	P	Roy W. Cook		River Terrace	120,000	15	1	Requires trenching and sampling to determine extent and quality of gravel																			
10002	21S	16E	NW	SE	3	P	Harry Thompson	C.A.,S.G.	River Terrace	45,000	7	0	1949	Concrete gravel sample		53.2	22.4	1.9								A-1-a			26.9	9.58	
10003	21S	16E	SW NW	SW NW	11 14			B.G.,S.G.	River Terrace	145,000	7	0-4	1962	Test Hole		0	34.0	100	62.8	37.1	32.1	26.8	8.2	15.4	NP	.011	A-1-a			26.0		
10004	21S	16E	SE	NE	15	CO	Thorn Const.Co.	C.A. B.G.,S.G.	River Terrace	155,000	11	0-1	1947					100		56.5	49.0	34.9	9.2	18.7	NP	.028	A-1-b			25.6		
10005	21S	17E	NE	NE	34			Borrow	Pediment	48,000	10	0	1947				30.5	100	69.3	38.3	26.8	18.2	5.2	18.3	3.9	.013	A-1-a			32.3		
10006	21S	17E	NE	SW	35			B.G.,S.G.	Stream Channel	Mined Out			1945				28.0	100	81.6	53.3	40.4	26.3	9.2	18.8	NP	.016	A-1-a			38.3		
10007	22S	18E	W½	NE	9	F	B.L.M.	B.G.,S.G.	Stream Channel	570,000	12	0-2	1957		0-12	0	8.1	100		73.8	63.8	54.3	22.4	17.0	NP	.012	A-2-4			38.0		
10008	22S	19E	SW	SW	4	F	B.L.M.	B.G.,S.G.	Pediment	Mined Out			1961			8.0	28.4	100	70.2	39.6	28.8	22.7	7.0	18.0	NP	.016	A-1-a			36.6		
10009	21S	20E	E½	SE	21				Pediment	215,000	15	3-6	Requires trenching and sampling to determine extent and quality of gravel																			
10010	21S	20E	W½ NE	NW NE	35 34			B.G.,S.G.	Pediment	250,000	40	0-5	1960	Cut Bank		0	27.6	100		30.8	19.5	12.3	3.4	19.1	NP	.012	A-1-a			38.1		
10011	21S	23E	W½	NE	32			Borrow	Pediment	38,000	4	0	1950			3.8	13.8	100		52.0	38.1	30.8	19.4	20.4	3.7	.010	A-1-b			36.3		
10012	21S	23E	W½ E½	NW NE	28 29	F	B.L.M.	Borrow	River Terrace	2,800,000	11	0	* 1966	Test Hole	4-10	3.8	13.5	100	79.6	54.0	* 45.5	* 31.0	11.6	21.4	NP		A-1-b	106	192	32.2	17.3	23.7
10013	21S	24E	E½	NW	5	F	B.L.M.	Riprap	Sandstone Bedrock	220,000	10	0	1966																	86.9		
10014	20S	24E		SW	29	F	B.L.M.	Borrow	River Terrace	1,180,000	13	0	* 1966	Test Hole	4-10	0	8.8	100	81.0	52.2	* 41.9	* 18.4	5.8	20.4	NP	.00	A-1-a	91	185	35.9	26.7	21.9
10015	20S	24E	SW	NE	11			Borrow, Select Base	Stream Channel	13,000	4	0	1956					100		86.9	72.8	38.7	4.3	18.3	NP		A-1-b					
10016	19S	25E	NW	SE	20			B.G.,S.G.	Pediment	290,000	14	0-3	* 1967	Cut Bank	0-9	0	10.8	100	76.9	52.5	* 44.6	* 31.0	17.0	17.5	NP	.002	A-1-b	120	264	31.4	18.2	13.6
10017	18S	25E	W½	SE	26			B.G.,S.G.	Pediment	370,000	18	0-2	* 1967	Cut Bank	0-18	0	15.8	100	73.6	44.4	* 32.8	* 13.7	5.3	17.4	NP	.006	A-1-a	211	291	29.3	11.7	19.1
10018	24S	20E	NW NE	SW SW	5	F	B.L.M.	Borrow	Stream Channel	24,000	5	0	1962			0	No Crushing 0.2	99.8		96.2	94.0	87.8	5.3	18.8	NP	0.0	A-3(0)					
10019	24S	20E	SW	SW	9	F	B.L.M.	Borrow	Stream Channel	72,000	5	0	1962			0	No Crushing 22.1	77.9		37.4	30.5	23.0	18.9	16.3	NP	0.06	A-1-b(0)					
10020	25S	20E	NE S½	NW NW	9			Borrow, Select Base	Stream Channel	56,000	5	0	1960			0	2.9	100		67.9	48.2	28.4	4.8	19.2	NP	.008	A-1-a					
10021	26S	21E	NE NW	NE NW	20 21	F	B.L.M.	B.G.,S.G.	River Terrace	Investigation Necessary	11	0	1962			17.8	41.6	100	65.6	33.3	23.9	16.7	5.0	16.9	NP	.012	A-1-a			20.0		
10022	26S	21E	SW	NW	5	P	Roy Cook	B.G.,S.G.	River Terrace	2,000	6	0	1962	Test Hole		2.6	39.8	100	57.5	34.8	30.6	27.0	2.3	18.1	NP	.016	A-1-a			21.2		
10023	26S	20E	NE	SE	25	P	Texas Gulf Sulphur Co.	B.G.,S.G.	River Terrace	45,000	10	0-2	1962			2.5	49.7	100	58.7	32.1	26.8	21.3	3.0	17.1	NP		A-1-a			21.6		
10024	26S	22E	NW	NE	7	P	Emma Walker	C.A. B.G.,S.G.	River Terrace	320,000	50	0-1	1958	Cut Bank		7.9	44.0	100		43.2	36.9	30.6	5.4	18.4	NP	.023	A-1-a			26.4		
10025	26S	22E	SE NE	NE SE	7	P	Howard Lance	C.A. B.G.,S.G.	River Terrace	800,000	50	0-1	1955			19.0	53.0	100		46.4	37.2	29.4	8.0	19.2	NP	.014	A-1-a			24.1		

* SAMPLES TESTED AFTER MID-1963 USE NO. 8 AND NO. 50 SIEVES RESPECTIVELY.

PITS AND POTENTIAL SITES - TEST DATA SHEET

LOCATION						OWNERSHIP		MATERIAL					TEST DATA - REPRESENTATIVE SAMPLE																				
																SIEVE ANALYSIS																	
																BEFORE CRUSHING		PERCENT PASSING AFTER CRUSHING TO 1" MAX. SIZE												IMMERSION COMPRESSION AVG. P.S.I.			SODIUM SULPHATE LOSS	
PIT OR SITE NUMBER	TOWNSHIP	RANGE	40 ACRE TRACT	QUARTER SECTION	SECTION	P = PRIVATE C = COMMERCIAL CO = COUNTY F = FEDERAL S = STATE	OWNER	USE OF MATERIAL	TYPE OF DEPOSIT	PRESENT ESTIMATED QUANTITY (CU. YDS.)	THICKNESS OF MATERIAL	DEPTH OF OVERBURDEN	DATE SAMPLED *	TYPE OF SAMPLE	DEPTH OF SAMPLE	> 3"	> 1"	1"	1/2"	NO. 4	NO. 10 *	NO. 40 *	NO. 200	LIQUID LIMIT	PLASTICITY INDEX	SWELL	A.A.S.H.O. CLASSIFICATION	LIME WO/	LIME W/	ABRASION 500 REV.	+4	-4
10026	25S	21E	S½	SW	24	F	B.L.M.	C.A. B.G.,S.G.	River Terrace	Mined Out			1958		0-3	11.7	37.2	100		46.2	39.4	33.5	9.2	17.6	NP	.013	A-1-b			20.0		
10027	25S	22E	E½	SW	19	F	B.L.M.	B.G.,S.G.	River Terrace	16,000	10	0	1958			3.1	49.1	100		34.4	27.1	20.0	3.4	16.3	NP	.008	A-1-a			26.3		
10028	24S	22E	W½	SW	33	F	B.L.M.	B.G.,S.G.	River Terrace	80,000	8	0	1958	Cut Bank	0-10	2.3	21.5	100		51.3	41.8	29.5	8.6	16.4	NP	.012	A-1-a			20.9		
10029	24S	22E	W½	NE	35	F	B.L.M.	B.G.,S.G.	River Terrace	460,000	12	0-1	1958	Cut Bank	0-12	23.4	46.7	100		42.2	34.3	21.6	5.4	17.5	NP	.010	A-1-a			29.3		
10030	24S	23E		NE	30	F	B.L.M.	B.G.,S.G.	River Terrace	290,000	20	0-1	1958	Cut Bank	0-10	11.9	34.3	100		39.8	35.7	21.2	1.1	22.2	NP	.015	A-1-a			24.4		
10031	22S	24E	SE E½	NW SW	3			B.G.,S.G.	Alluvium	Investigation Necessary			* 1966			12.7	42.6	100	59.0	42.7	37.7 *	20.2 *	4.7				A-1-a	134	265	22.5		

* SAMPLES TESTED AFTER MID-1963 USE NO. 8 AND NO. 50 SIEVES RESPECTIVELY.

PITS AND POTENTIAL SITES - TEST DATA SHEET

LOCATION						OWNERSHIP		MATERIAL					TEST DATA - REPRESENTATIVE SAMPLE																			
PIT OR SITE NUMBER	TOWNSHIP	RANGE	40 ACRE TRACT	QUARTER SECTION	SECTION	P = PRIVATE C = COMMERCIAL CO = COUNTY F = FEDERAL S = STATE	OWNER	USE OF MATERIAL	TYPE OF DEPOSIT	PRESENT ESTIMATED QUANTITY (CU. YDS.)	THICKNESS OF MATERIAL	DEPTH OF OVERBURDEN	DATE SAMPLED *	TYPE OF SAMPLE	DEPTH OF SAMPLE	SIEVE ANALYSIS								LIQUID LIMIT	PLASTICITY INDEX	SWELL	A. A. S. H. O. CLASSIFICATION	IMMERSION COMPRESSION AVG. P.S.I.		ABRASION 500 REV.	SODIUM SULPHATE LOSS	
																BEFORE CRUSHING		PERCENT PASSING AFTER CRUSHING TO 1" MAX. SIZE										LIME				
																> 3"	> 1"	1"	1/2"	NO. 4	NO. 10*	NO. 40*	NO. 200					WO/	W/		+4	-4

* SAMPLES TESTED AFTER MID-1963 USE NO. 8 AND NO. 50 SIEVES RESPECTIVELY.

PITS AND POTENTIAL SITES - TEST DATA SHEET

LOCATION						OWNERSHIP		MATERIAL					TEST DATA - REPRESENTATIVE SAMPLE																				
PIT OR SITE NUMBER	TOWNSHIP	RANGE	40 ACRE TRACT	QUARTER SECTION	SECTION	P = PRIVATE C = COMMERCIAL CO = COUNTY F = FEDERAL S = STATE	OWNER	USE OF MATERIAL	TYPE OF DEPOSIT	PRESENT ESTIMATED QUANTITY (CU. YDS.)	THICKNESS OF MATERIAL	DEPTH OF OVERBURDEN	DATE SAMPLED *	TYPE OF SAMPLE	DEPTH OF SAMPLE	SIEVE ANALYSIS									LIQUID LIMIT	PLASTICITY INDEX	SWELL	A. A. S. H. O. CLASSIFICATION	IMMERSSION COMPRESSION AVG. P.S.I.		ABRASION 500 REV.	SODIUM SULPHATE LOSS	
																BEFORE CRUSHING		PERCENT PASSING AFTER CRUSHING TO 1" MAX. SIZE											LIME				
																> 3"	> 1"	1"	1/2"	NO. 4	NO. * 10	NO. * 40	NO. 200					WO/	W/		+4	-4
10032	21S	23E	S½	NW¼	35	S	State Land Brd.																									
10033	26S	19E	NW	NE	22	F	National Park	S.A.,B.G.	Bedrock	Limestone	bed	+2'	thick used in surfacing Dead Horse Pt. road. This area is mined out but the bed occurs in other knolls in the area.																			
10034	19S	25E	E½	SW NW	15 22	F	B.L.M.	Riprap																								
10035	20S	25E		SE	11			B.G.,S.G.	Stream Channel				1969	Test Hole		5	53	100	74	35	31	10	4	18	NP	.001	A-1-a(0)			22		
10036	21S	23E	N½ SW	SE SW	31 29	S	State Land Brd.	B.G.,S.G.					1970																			

* SAMPLES TESTED AFTER MID-1963 USE NO. 8 AND NO. 50 SIEVES RESPECTIVELY.